

# NASA TECH BRIEF



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## Fuse and Switch Functions Combined Within a Single Housing

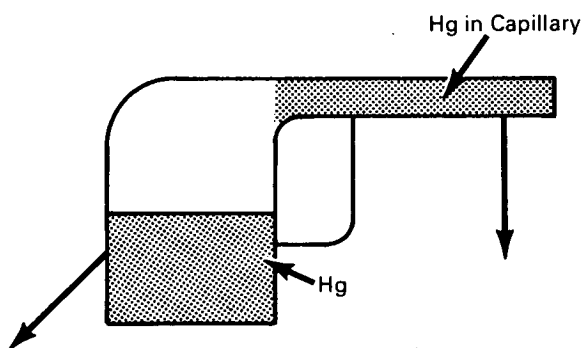


Figure 1. "ON" Position (Fuse Conducting)

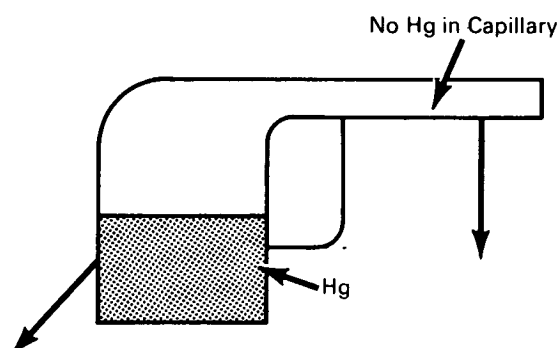


Figure 2. "ON" Position (Fuse Open)

### The problem:

To design a switch and fuse in a single housing. A mercury (Hg) capillary would be used to alternately vaporize and condense the Hg within a reservoir.

### The solution:

A device, known as a "fuswitch," that provides both switch and fuse functions within a single housing. This silent, fast-acting device in the "on" position protects the equipment to which it is connected (Figure 1). When the device is in the position shown in Figure 3, the current is turned off as in a conventional Hg switch. If an overload condition arises, the Hg in the capillary is heated to the point where it vaporizes and breaks the electrical connection (Figure 2). After the fuse "opens," the Hg condenses in the storage space located below the capillary, but gravity prevents the circuit from being closed again (Figure 3), until the switch is moved to the "off" (reset) position. The Hg then reenters the capillary, aided by gravity, but circuit continuity is reestablished only after the device is moved to the "on" position. The ampere rating and time constants of the fuswitch are determined by the

length and diameter of the capillary. The housing must be impervious to mercury and the connecting wires must not be adversely affected by reaction with Hg (amalgamation). The fuse portion of the device operates on the principle of the self-healing Hg fuse, except that its cyclic action is prevented, a significant improvement.

### How it's done:

The housing may be made of two plastic disks containing identical half channels with a groove and tong fit, and appropriate half channels for the electrical conductors. Hg is metered into one side of the cavity, the conductors are laid into the bottom disk, the top disk is pressed on, and the assembly is evacuated and sealed by heating the thermoplastic material to itself and to the coated wire. The housing, which may be either clear, colored transparent, or colored translucent, will be so designed that the user can see the position of the Hg. Integral plastic stops would limit the movement of the fuswitch, which may be grooved around its periphery so that it can be pressed into its retaining plate. A grip such as a knob

(continued overleaf)

or blade can be molded into the disks, for which space must be provided at the rear of the retaining plate. The plate would have corresponding stops. In addition, an optional external indication of fuse condition may be provided by an integral lamp connected across points A and B shown in Figure 3.

This innovation would be useful because switching contacts are available, thus providing internal indication and alarm for the open circuit condition.

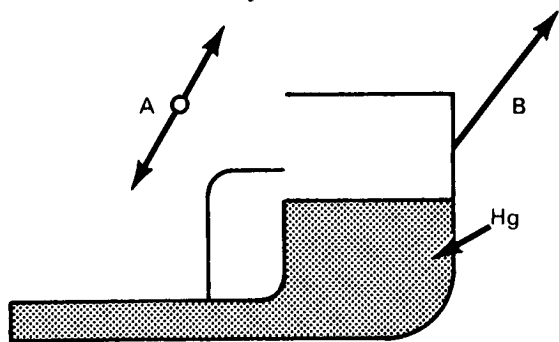


Figure 3. "OFF-Reset" Position

#### Note:

No further documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer  
Headquarters

National Aeronautics

and Space Administration

Washington, D.C. 20546

Reference: B70-10003

#### Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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